Air Cargo Economics

Prof. John-Paul Clarke

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Air Transportation Systems Architecting
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Lecture Outline

• Air Cargo Industry
  – Types of air cargo and air cargo carriers
  – Largest air cargo carriers

• Demand for Air Cargo Services
  – Drivers of air cargo growth
  – Constraints on growth

• Recent Trends in Air Cargo
  – Traffic and tariffs
  – Industry structure
  – Impacts of recent recession and 9/11

• Breakdown of Cargo Revenue and Cost
Air Cargo Industry

• **Air Cargo Categories**
  – Express/time definite: small packages (less than 100 lb.)
  – Heavyweight freight shipments (greater than 100 lb.)
  – Mail transport

**Participants:**

• **All-Cargo Airlines**
  – Integrated Express Carriers (express/small packages; door to door service)
  – Non-integrated Freight Carriers (heavyweight freight shipments; work with freight forwarders, etc.)

• **Passenger (Combination) Airlines**
  – Can carry air freight, express packages and mail in passenger aircraft belly or on “combi” aircraft
  – Also can have dedicated freight aircraft
<table>
<thead>
<tr>
<th>Carrier</th>
<th>Ton-miles (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Federal Express</td>
<td>7,466</td>
</tr>
<tr>
<td>2. Lufthansa German Airlines</td>
<td>4,995</td>
</tr>
<tr>
<td>3. Singapore Airlines</td>
<td>4,188</td>
</tr>
<tr>
<td>4. Korean Air</td>
<td>3,873</td>
</tr>
<tr>
<td>5. Air France</td>
<td>3,553</td>
</tr>
<tr>
<td>6. Japan Air Lines</td>
<td>3,226</td>
</tr>
<tr>
<td>7. United Airlines</td>
<td>3,153</td>
</tr>
<tr>
<td>8. KLM Royal Dutch Airlines</td>
<td>2,969</td>
</tr>
</tbody>
</table>

Source: Aviation and Aerospace Almanac 2002
## Top U.S. Air Cargo Airlines in 2001
### Total Freight and Mail (Int’l + Domestic)

<table>
<thead>
<tr>
<th>Carrier</th>
<th>Ton-miles (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Federal Express</td>
<td>7,565</td>
</tr>
<tr>
<td>2. UPS Airlines</td>
<td>4,081</td>
</tr>
<tr>
<td>3. United Airlines</td>
<td>1,919</td>
</tr>
<tr>
<td>4. Northwest Airlines</td>
<td>1,918</td>
</tr>
<tr>
<td>5. American Airlines</td>
<td>1,813</td>
</tr>
<tr>
<td>6. Delta Airlines</td>
<td>1,269</td>
</tr>
<tr>
<td>7. Atlas Air</td>
<td>1,072</td>
</tr>
<tr>
<td>8. Polar Air Cargo</td>
<td>892</td>
</tr>
</tbody>
</table>

Source: ATA Annual Report 2002
# Selected Cargo Carriers 2001 (Source: ATA)

<table>
<thead>
<tr>
<th>Carrier</th>
<th>Number of Aircraft</th>
<th>Air Cargo Ton-miles (millions)</th>
<th>Cargo Revenue ($ million)</th>
<th>% of Operating Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>FedEx</td>
<td>320</td>
<td>7,609</td>
<td>$ 6,948</td>
<td>45.8 %</td>
</tr>
<tr>
<td>UPS Air</td>
<td>258</td>
<td>4,094</td>
<td>$ 2,624</td>
<td>96.6 %</td>
</tr>
<tr>
<td>United</td>
<td>543</td>
<td>2,390</td>
<td>$ 704</td>
<td>4.3 %</td>
</tr>
<tr>
<td>Northwest</td>
<td>440</td>
<td>2,161</td>
<td>$ 715</td>
<td>7.5 %</td>
</tr>
<tr>
<td>KLM</td>
<td>132</td>
<td>2,512</td>
<td>$ 882</td>
<td>15.5 %</td>
</tr>
</tbody>
</table>
Demand for Air Cargo Services

- Like demand for passenger air travel, demand for air cargo shipment is a “derived” demand.

- **Primary drivers of air cargo demand include:**
  - Economic growth and trade (especially imports/exports)
  - Relative prices of air cargo versus alternatives – ocean, truck, rail

- **Difficult to quantify demand/supply accurately:**
  - No comprehensive sources of data on air cargo traffic and pricing
  - Lack of published schedule data (unlike passenger airlines)
  - Vertically integrated air cargo operators (like Fedex and UPS) only publish limited schedules for selected flights
  - All-cargo carriers tend to operate flexibly based on daily/weekly demands
  - Combination carriers provide joint supply of cargo and passenger capacity
Drivers of Air Cargo Growth in 1990s

• Overall economic growth (especially world trade)
  – Historically, 2 to 2.5% increase in world trade with each 1% increase in total GDP
  – Air freight trade has been growing even faster, due to regional differences in economic growth
  – Since 1993, average 7-10% annual growth in world air freight traffic

• Globalization
  – Increasingly integrated and interdependent national economies
  – Liberalized (free) trade and reduced protectionism

• Lean Inventory Strategies
  – Reduced order-cycle times: “just in time” and “make to order”
  – Less stock on hand to avoid production shutdowns, retail stockouts
  – Air freight shortens delivery times to customer
Constraints on Air Cargo Growth

• Economic recession
  – Reduced production, demand for goods, international trade

• Trade barriers
  – Tariffs or protectionism designed to limit free trade

• Aircraft regulations
  – Air cargo operators have used older aircraft that are most affected by new regulations on noise, emissions and safety
  – For example, noise hush-kits reduce cargo payloads

• Modal competition
  – Air freight has tremendous speed advantage for long distances, but is highest-cost option
  – Trucks very competitive for short haul (1000 miles, overnight)
  – Development of new “fast ships” for ocean cargo
Recent Trends in Air Cargo

• **Rapid growth in demand for air cargo**
  – Intra-Asia is the largest true air freight market
  – Even during Asian economic crisis air freight traffic grew
  – Forecasts for continued traffic growth at 6% per year

• **Falling real yields (revenue per ton-mile)**
  – Average 2.5% decline in yields (CPI adjusted)
  – Growth in international trade has increased trip length, associated with lower tariffs per mile
  – Wide-body aircraft have unused belly capacity, viewed by passenger airlines as virtually “costless”
    • Passenger airlines have become price leaders in air freight
  – Regulatory liberalization has spurred price competition
    • Lower tariffs further stimulate demand, but also cause airlines to focus on lowering unit costs
Trends in Air Cargo (cont’d)

• Integrator expansion
  – Integrated express carriers own air and ground assets to handle entire shipment journey
  – Fedex and UPS, facing competition and decreasing yields in express documents, expanded to international markets
  – With limited international small package growth, carry standard air freight (airport to airport) as “filler”
  – Trying to develop products for higher-yield industrial traffic

• Consolidation of freight forwarders
  – Non-integrated carriers receive majority of traffic from freight forwarders – FFs handle retail marketing and pick-up/delivery
  – Number of mid-sized freight forwarders has been shrinking, leaving largest operators and niche competitors
Air Cargo Outlook (Source: Al Haggerty)

- Global AIRLINE PAX TRAFFIC forecast to grow @ 4.5% per year between 1999 and 2010
- Global AIR FREIGHT forecast to grow @ 6.0% per year between 1999 and 2010
- ASIA-PACIFIC REGION expected to dominate air freight market
- UNIT COSTS declined at an average annual rate of 3.0% between 1960 and 1999
- Larger, more efficient freighters are making air freight more competitive
Operating Profit Margin, Year 2000

- DHL: -4%
- FedEx: 6%
- UPS: 4%
- Passenger Majors: 5.5%
Load Factors (Domestic Cargo Carriers)

Ton Load Factor for Scheduled Cargo Service

- DHL: 54%
- FedEx: 62%
- UPS: 62%
727-200 Hourly Operating Cost Breakdown, Q1 2001

Crew 28%
Fuel/Oil 33%
Depreciation 10%
Maintenance 14%
Rentals 1%
Burden 10%
Other 1%
Taxes 3%
Insurance 0%

Estimated from data for passenger aircraft
757-200 Hourly Operating Cost Breakdown, Q1 2001

- Crew: 24%
- Fuel/Oil: 28%
- Rentals: 15%
- Depreciation: 7%
- Maintenance: 14%
- Taxes: 2%
- Burden: 9%
- Other: 1%

Estimated from data for passenger aircraft
767-200 Hourly Operating Cost Breakdown, Q1 2001

- **Crew**: 26%
- **Fuel/Oil**: 31%
- **Rentals**: 3%
- **Depreciation**: 7%
- **Maintenance**: 18%
- **Burden**: 10%
- **Other**: 3%
- **Taxes**: 2%
- **Insurance**: 0%
- **Depreciation**: 7%
- **Rentals**: 3%

Estimated from data for passenger aircraft
767-300 Hourly Operating Cost Breakdown, Q1 2001

- Crew: 28%
- Fuel/Oil: 34%
- Rentals: 13%
- Depreciation: 5%
- Maintenance: 8%
- Burden: 9%
- Other: 1%
- Insurance: 0%
- Taxes: 2%

Estimated from data for passenger aircraft
DC-10-30 Hourly Operating Cost Breakdown, Q1 2001

- Crew: 15%
- Fuel/Oil: 34%
- Maintenance: 25%
- Burden: 9%
- Other: 1%
- Crew: 15%
- Insurance: 0%
- Taxes: 1%
- Depreciation: 9%
- Rentals: 6%

Estimated from data for passenger aircraft
MD-11 Hourly Operating Cost Breakdown, Q1 2001

- Crew: 22%
- Fuel/Oil: 34%
- Maintenance: 12%
- Depreciation: 10%
- Burden: 7%
- Other: 1%
- Taxes: 2%
- Insurance: 0%
- Rentals: 12%

Estimated from data for passenger aircraft
747-200 Hourly Operating Cost Breakdown, Q1 2001

- Crew: 18%
- Fuel/Oil: 34%
- Rent: 7%
- Depreciation: 4%
- Maintenance: 15%
- Burden: 20%
- Other: 1%

Estimated from data for passenger aircraft
747-400 Hourly Operating Cost Breakdown, Q1 2001

- Crew: 24%
- Fuel/Oil: 34%
- Rentals: 15%
- Maintenance: 10%
- Taxes: 1%
- Depreciation: 5%
- Burden: 10%
- Other: 1%

Estimated from data for passenger aircraft
Number of Aircraft (Narrow Body)

• Payload less than 60,000 lbs
  – 727-100  215
  – 727-200  283
  – 737-200/300  35
  – Bae 146  25
  – DC-9  104

• Payload between 60,000 & 120,000 lbs (narrow body)
  – 707-320  55
  – 757-200  80
  – DC-8-50/60  103
  – DC-8-70  103
Number of Aircraft (Wide Body)

• Payload between 70,000 & 140,000 lbs (wide body)
  – A300-B4  67
  – A300-600 45
  – A310-200 41
  – 767-200  16
  – 767-300  16
  – DC-10-10 40
  – MD-10-10  1
  – L-1011   11
Number of Aircraft (Wide Body)

- Payload more than 140,000 lbs
  - 747-100 30
  - 747-200 137
  - 747-300 4
  - 747-400 50
  - DC-10-30 51
  - DC-10-40 3
  - MD-10-30 1
  - MD-11 77
Key Questions

- Where can an air cargo carrier reduce cost?
- If you could automate aircraft operations, which aircraft type would give you the best leverage?
- Is there any specific segment of the air cargo market that is primed for growth?
- How would you “grow” this market segment?